Appendix A
Acronyms & Definition of Terms

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A. Acronyms & Definition of Terms

A.1 Acronyms

AC - Advisory Circular

ACARS - Aircraft Communications, Addressing and Reporting System

ACAS – Airborne Collision Avoidance System

ACR – Adjacent Channel Reduction

ADS - Automatic Dependent Surveillance

ADS-B - Automatic Dependent Surveillance-Broadcast

AGL - Above Ground Level

APDU – Application Protocol Data Unit

ASA – Aircraft Separation Assurance

A/V - Aircraft/Vehicle

ATCRBS - Air Traffic Control Radar Beacon System

ATC - Air Traffic Control

ATM - Air Traffic Management

ATS - Air Traffic Services

ATIS - Automatic Terminal Information Service

BCD - Binary Coded Decimal

BDS - Comm-B Data Selector

BER - Bit Error Rate

BNR - Binary Numbers

bps – Bits Per Second

BW - Bandwidth

C/A - Coarse Acquisition

CPA - Closest Point of Approach

CNS - Communications, Navigation and Surveillance

CDTI - Cockpit Display of Traffic Information

CEFR – CDTI-based Electronic Flight Rules

CPDLC – Controller-Pilot Data Link Communications

CRC - Cyclic Redundancy Check

CW - Continuous Wave

dB – Decibel

dBm – Decibel with respect to 1 milliwatt

DME - Distance Measuring Equipment

DOD - U.S. Department of Defense

DOP - Dilution Of Precision

ELT - Emergency Locating Transmitter

EPU - Estimated Position Uncertainty

E/W – East/West

ERP - Effective Radiated Power

ETA - Estimated Time of Arrival

EUROCAE - European Organization for Civil Aviation Equipment

FAA - Federal Aviation Administration

FAR - Federal Aviation Regulation

FEC – Forward Error Correction

FIS-B - Flight Information Services-Broadcast

FMS - Flight Management System

f_0 – Nominal or Center Frequency

fpm - Feet Per Minute

FSD - Full Scale Deflection

FSS - Flight Service Station

FTE - Flight Technical Error

GNSS - Global Navigation Satellite System

GPS - Global Positioning System

h – Modulation Index

Hz - Hertz

IAS - Indicated Airspeed

ICAO - International Civil Aviation Organization

IFR - Instrument Flight Rules

ILS - Instrument Landing System

IMC - Instrument Meteorological Conditions

INS - Inertial Navigation System

I/O - Input and/or Output

ISI – Inter-Symbol Interference

ITU - International Telecommunication Union

JAA - Joint Aviation Authorities

JAR - Joint Aviation Requirements

JTIDS – Joint Tactical Information Distribution System (a.k.a. Link 16)

kHz – Kilohertz

L1 - 1575.42 MHz (a navigation frequency associated with GPS)

LAAS - Local Area Augmentation System

LADGPS - Landing Area Differential GPS

LSB - Least Significant Bit

MASPS - Minimum Aviation System Performance Standards

Mbps – Million Bits Per Second

MFD - Multi-Functional Display

MHz - Megahertz

MIDS – Multifunctional Information Distribution Systems

MOPS - Minimum Operational Performance Standards

ms – Milliseconds

MSL - Minimum Signal Level

MTBF - Mean Time Between Failure

MTL - Minimum Trigger Level

NAS - U.S. National Airspace System

NAV - Navigation

NAVAID - Navigation Aid

NM - Nautical Mile

NOTAM - Notice to Airmen

N/S – North/South

ONE, ONEs – The affirmative value of a binary bit.

PIREP - Pilot Report

PPM – Parts Per Million

PPS – Pulse Per Second

P_r - Probability of Receipt

PSR - Primary Surveillance Radar

PUME – Probability of Undetected Message Error

RA - Resolution Advisory

RAIM - Receiver Autonomous Integrity Monitoring

RCP - Required Communication Performance

RF - Radio Frequency

rms - Root Mean Square

RNP - Required Navigation Performance

RSP - Required System Performance

rss - Root-Sum-Square

RVSM - Reduced Vertical Separation Minimum

SA or S/A - Selective Availability

SAE - Standard Aerospace Equipment

SAR - Search And Rescue

SARPS - Standards and Recommended Practices

SID - Standard Instrument Departure

SNR - Signal-to-Noise Ratio

SPS - Standard Positioning Service

SSR - Secondary Surveillance Radar

SUA - Special Use Airspace

TA - Traffic Advisory

TACAN – Tactical Air Navigation

TAS - True Airspeed

TCAS - Traffic Alert and Collision Avoidance System

TERPS - Terminal Instrument Procedures

TIS - Traffic Information Service

TIS-B - Traffic Information Service-Broadcast

TMA - Terminal Maneuvering Area

TOMR – Time of Message Receipt

TOMT – Time of Message Transmission

TSD - Traffic Situation Display (see also CDTI)

TSE - Total System Error

TSO - Technical Standards Order

U.S. - United States

µsec – Micro Second

UTC - Coordinated Universal Time

UUT – Unit Under Test

VFR - Visual Flight Rules

VMC - Visual Meteorological Conditions

VSWR – Voltage Standing Wave Ratio

W – Watts

WAAS - Wide Area Augmentation System

WGS-84 - World Geodetic System 1984

Xmt - Transmit

ZERO, ZEROs – The negation value of a binary bit.

A.2 Definition of Terms

Accuracy - A measure of the difference between the A/V position reported in the ADS-B message field as compared to the true position. Accuracy is usually defined in statistical terms of either 1) a mean (bias) and a variation about the mean as defined by the standard deviation (sigma) or a root mean square (rms) value from the mean. The values given in this document are in terms of the two-sigma variation from an assumed zero mean error.

Active Waypoint - A waypoint to or from which navigational guidance is being provided. For a parallel offset, the active waypoint may or may not be at the same geographical position as the parent waypoint. When not in the parallel offset mode (operating on the parent route), the active and parent waypoints are at the same geographical position.

ADS-B Broadcast and Receive Equipment - Equipment that can transmit and receive ADS-B messages. Defined as Class A equipment.

ADS-B Broadcast Only Equipment - Equipment that can transmit but not receive ADS-B messages. Defined as Class B equipment.

ADS-B Message – A modulated packet of formatted data which conveys information used in the development of ADS-B reports.

ADS-B Report – Specific information provided by the ADS-B user participant subsystem to external applications. Reports contain identification, state vector, and status/intent information. Elements of the ADS-B Report that are used and the frequency with which they must be updated will vary by application. The portions of an ADS-B Report that are provided will vary by the capabilities of the transmitting participant.

ADS-B Subsystem - The set of avionics or equipment that performs ADS-B functionality in an aircraft or for ground-based, non-aircraft, participants.

ADS-B System - A collection of ADS-B subsystems wherein ADS-B messages are broadcast and received by appropriately equipped participant subsystems. Capabilities of participant subsystems will vary based upon class of equipage.

Advisory - An annunciation that is generated when crew awareness is required and subsequent crew action may be required; the associated color is unique but not red or amber/yellow. (Source: Advisory Circular AC 25 - 11).

Aircraft Address - The term “address” is used to indicate the information field in an ADS-B message that identifies the ADS-B unit that issued the message. The address provides a continent means by which ADS-B receiving units—or end applications—can sort messages received from multiple issuing units.

Aircraft/Vehicle (A/V) - Either 1) a machine or service capable of atmospheric flight, or 2) a vehicle on the airport surface movement area. In addition to A/Vs, ADS-B equipage

may be extended to temporarily uncharted obstacles (i.e., obstacles not identified by a current NOTAM).

Air Mass - Air mass data includes barometric altitude and air speed.

Alert Zone - In the Free Flight environment, each aircraft will be surrounded by two zones, a protected zone and an alert zone. The alert zone is used to indicate a condition where intervention may be necessary. The size of the alert zone is determined by aircraft speed, performance, and by CNS/ATM capabilities.

Algorithm – A set of well-defined rules for the solution of a problem in a finite number of steps.

Along-Track Distance - The distance along the desired track from the waypoint to the perpendicular line from the desired track to the aircraft.

Applications - Specific use of systems that address particular user requirements. For the case of ADS-B, applications are defined in terms of specific operational scenarios.

Application Interface – The Application Interface is responsible for the extraction of ADS-B Reports from the Report Output Storage Buffer via the Report to Application Interface. Requirements for the Application Interface and Report to Application Interface are to be specified in various Application Interface specifications and therefore are not addressed in this document.

Barometric Altitude - Geopotential altitude in the earth's atmosphere above mean standard sea level pressure datum surface, measured by a pressure (barometric) altimeter.

Barometric Altitude Error - For a given true barometric pressure, P_o, the error is the difference between the transmitted pressure altitude and the altitude determined using a standard temperature and pressure model with P_o.

Call Sign - The term “aircraft call sign” means the radiotelephony call sign assigned to an aircraft for voice communications purposes. (This term is sometimes used interchangeably with “flight identification” or “flight ID”). For general aviation aircraft, the aircraft call sign is normally its national registration number; for airline and commuter aircraft, it is usually comprised of the company name and flight number (and therefore not linked to a particular airframe); and for the military, it usually consists of numbers and code words with special significance for the operation being conducted.

Caution - An annunciation that is generated when immediate crew awareness is required and subsequent crew action will be required; the associated color is amber/yellow. (Source: Advisory Circular AC25 - 11).

Closest Point of Approach (CPA) - The minimum horizontal distance between two aircraft during a close proximity encounter, a.k.a. miss distance.

Cockpit Display of Traffic Information (CDTI) - A function which provides the pilot/flight-crew with surveillance information about other aircraft, including their position. The information may be presented on a dedicated multi-function display (MFD), or be processed for presentation on existing cockpit flight displays. Traffic information for the CDTI function may be obtained from one or multiple sources (including ADS-B, TCAS, and TIS) and it may be used for a variety of purposes. Requirements for CDTI information will be based on intended use of the data (i.e., application).

Collision Avoidance - An unplanned maneuver to avoid a collision.

Conflict - Any situation involving two or more aircraft, or an aircraft and an airspace, or an aircraft and ground terrain, in which the applicable separation minima may be violated.

Conflict Detection - The process of projecting an aircraft's trajectory to determine whether it is probable that the applicable separation minimum will not be maintained between the aircraft and either 1) another aircraft or vehicle, 2) a given airspace, or 3) ground terrain. The level of uncertainty in the projection is reduced with increased knowledge about the situation, including aircraft capabilities, flight plan, short term intent information, etc.

Conflict Management - Process of detecting and resolving conflicts.

Conflict Probe - The flight paths are projected to determine if the minimum required separation will be violated. If the minima are not [projected to be] violated, a brief preventive instruction will be issued to maintain separation. If the projection shows the minimum required separation will be violated, the conflict resolution software suggests an appropriate maneuver.

Conflict Resolution - The process of identifying a maneuver or set of maneuvers that, when followed, do not cause a conflict or reduce the likelihood of conflict between an aircraft and either 1, another aircraft or vehicle, 2, a given airspace, or 3, ground terrain. Maneuvers may be given to multiple aircraft to fully resolve a conflict.

Conformance - The condition established when the surveillance report of an aircraft's position at some time "t" (established by the Automated Tracking function) is within the conformance region constructed around that aircraft at its nominal position at time "t", according to the agreed upon trajectory.

Cooperative Separation - This concept envisions a transfer of responsibility for aircraft separation from ground based systems to the air-crew of appropriately equipped aircraft, for a specific separation function such as In-trail merging or separation management of close proximity encounters. It is cooperative in the sense that ground-based ATC is involved in the handover process, and in the sense that all involved aircraft must be appropriately equipped, e.g., with RNAV and ADS-B capability, to perform such functions.

Co-ordinated Time Scales – A time scale synchronised within stated limits to a reference time scale. Co-ordinated Universal Time (UTC) is the time scale maintained by Bureau International des Poids et Mesures (BIPM), and the International Earth Rotation

Service (IERS), which forms the basis of a co-ordinated dissemination of standard frequencies and time signal. It corresponds exactly in the rate with the International Atomic Time (TAI), but differs from it by an integer number of seconds.

Cross-link - A cross-link is a special purpose data transmission mechanism for exchanging data between two aircraft — a two-way addressed data link. For example, the TCAS II system uses a cross-link with another TCAS II to coordinate resolution advisories that are generated. A cross-link may also be used to exchange other information that is not of a general broadcast nature, such as intent information.

Desensitization – Temporary reduction of transponder sensitivity after receipt of a signal. Used to reduce echo (multipath) effects.

Desired Course - Can be either 1) True - A predetermined desired course direction to be followed (measured in degrees from true north), or 2) Magnetic - A predetermined desired course direction to be followed (measured in degrees from local magnetic north).

Diversity – A method of selecting the reply transmission path based on the relative amplitude of the received interrogation signal from two or more channels with independent antennas.

Downlink – A signal propagated from the transponder.

Dynamic Range – The ratio between the overload level and the minimum triggering level in a transponder.

Effective Update Interval - The time interval between successful message receipt with at least 98% probability of successful reception. For example, if ADS-B messages are sent at one second intervals in signal-to-noise conditions with 75% probability of success per transmission, then the probability of obtaining at least one message in three tries is $= 1. - (0.25)^3 \sim 98.4\%$. Thus the effective update interval for this case = 1 sec x 3 = 3 sec.

Effective Update Rate - The reciprocal of effective update interval, e.g. rate = 1/3 ~ 0.33 Hz for the example above.

En Route - A phase of navigation covering operations between departure and termination phases. En route phase of navigation has two subcategories: en route domestic/continental and en route oceanic.

Event Driven - Messages that are broadcast periodically for a duration of the operational condition. Examples of event driven messages include Emergency/Priority Status *(ref. RTCA/DO-242A, Section 2.1.2.18)* and aircraft intent *(ref. RTCA/DO-242A, Section 2.1.2.19)*.

Field – A group of bits in a message treated as a single unit of information.

Format – The specific order in which fields of information appear in a Mode S digital message transmission.

FRUIT – Transponder replies unsynchronized in time. See Garble, Non-synchronous.

Garble, Non-synchronous – Reply pulses received from a transponder that is being interrogated from some other source. Also called FRUIT.

Geometric Dilution of Position (GDOP) - The ratio of position error of a multi-lateration system. More precisely, it is the ratio of the standard deviation of the position error to the standard deviation of the measurement errors, assuming all measurement errors are statistically independent and have a zero mean and the same standard distribution. GDOP is the measure of the "goodness" of the geometry of the multi-lateration sources as seen by the observer; a low GDOP is desirable, a high GDOP undesirable. (See also PDOP, HDOP and VDOP.)

Geometric Height - The minimum altitude above or below a plane tangent to the earth's ellipsoid as defined by WGS84.

Geometric Height Error - Geometric height error is the error between the true geometric height and the transmitted geometric height.

Global Navigation Satellite System (GNSS) - GNSS is a world-wide position, velocity, and time determination system, that includes one or more satellite constellations, receivers, and system integrity monitoring, augmented as necessary to support the required navigation performance for the actual phase of operation.

Global Positioning System (GPS) - A space-based positioning, velocity and time system composed of space, control and user segments. The space segment, when fully operational, will be composed of 24 satellites in six orbital planes. The control segment consists of five monitor stations, three ground antennas and a master control station. The user segment consists of antennas and receiver-processors that provide positioning, velocity, and precise timing to the user.

GNSS Altitude (MSL) - The height of the aircraft (or of its GNSS antenna) above the *geoid*, which is the surface that represents mean sea level. The term *geoid,* as defined by the National Geodetic Survey's *Geodetic Glossary,* is the equipotential surface of the Earth's gravity field which best fits, in the least squares sense, mean sea level.

Graticule – A network of lines on a map representing geographic parallels and meridians.

Ground Uplink Message – A message containing 432 bytes of payload transmitted only by UAT ground stations and only within the ground segment of the UAT frame.

Horizontal Dilution of Precision (HDOP) - The ratio of user-referenced horizontal position error to measurement error of a multi-lateration system. (See GDOP for a more detailed description.)

International Atomic Time (TAI) – The time scale established by the Bureau International des Poids et Mesures (BIPM) on the basis of data from atomic clocks operating in several establishments conforming to the definition of the second, the unit of the time of the International System of Units (SI).

In-Trail Climb - In-trail climb (ITC) procedures enables trailing aircraft to climb to a more fuel-efficient or less turbulent altitude.

In-Trail Descent - In-trail descent (ITD) procedures enables trailing aircraft to descend to a more fuel-efficient or less turbulent altitude.

Latency - The latency of an ADS-B transmission is the time period from the time of applicability of the aircraft/vehicle position ADS-B report until the transmission of that ADS-B report is completed.

Latency Compensation - High accuracy applications may correct for system latency introduced position errors using ADS-B time synchronized position and velocity information.

Message – An arbitrary amount of information whose beginning and end are defined or implied. In this document, the information content of the message fields MA, MB, MC, FlD, MU and MV (see Figures 2-4 and 2-5).

Monopulse – A radar system using a receiving antenna having two or more partially overlapping lobes in the radiation pattern. Sum and difference channels in the receiver compare the amplitudes or phases of the received signal.

Multipath – The propagation phenomenon that results in signals reaching the receiving antenna by two or more paths, generally with a time or phase difference between the two.

National Airspace System (NAS) – The common system of facilities, equipment, regulations, procedures and personnel providing services and standard procedures for the safe and efficient movement of civil and military aircraft within the jurisdiction of the United States.

Near Term - Near-term applications are defined as those that can be supported by an initial ADS-B implementation and that may be operationally feasible within the context of a current ATC system or the ATC systems of the near future.

Normal Maneuver - Any maneuvers within the aircraft's approved flight-loads envelope that does not exceed 60 degrees angle of bank, or results in an abrupt change in the aircraft's attitude or accelerations. Abrupt changes in accelerations are those that exceed the values shown below. *Note that g = acceleration of gravity = 9.8 m/s^2.*

Horizontal Acceleration	Vertical Acceleration	Total Jerk
0.58 g	0.5 g	0.25 g/s

Optimum Sampling Point – The point during the bit period at which the opening of the eye diagram (i.e., the minimum separation between positive and negative frequency offsets at very high signal–to-noise ratios) is maximized.

Planned Primary Means - Use of ADS-B for Planned Primary Means will be possible for selected airspace operations based upon predictable conditions, e.g., GNSS constellation, type of operation, and extent of ADS-B equipage for participating aircraft. That is, ADS-B will be available as a primary means of surveillance for particular periods of time in particular geographical regions for approved operations.

Phase of Flight - The phases of flight are defined as follows:

1. Oceanic/Remote - Radio updating is not viable due to either very limited navigation aid coverage or no navigation aid coverage.

2. En Route/Domestic - Aircraft sequences above 15,500 feet while not actively flying a SID, or is above 15,500 and sequences the last waypoint of a SID, or the phase of flight is Oceanic and radio updating is viable.

3. Terminal - Aircraft sequences below 15,000 feet; or when the aircraft is in Approach and exceeds 3,000 feet above arrival airport elevation if there is no missed approach holding point, or the missed approach holding point is sequenced; or the aircraft is in Takeoff and exceeds 3,000 feet above departure airport elevation if no SID exist in active flight plan, or the last waypoint of the SID is sequenced below 15,500.

4. Approach - The first waypoint on the active approach or approach transition is sequenced, or the aircraft sequences below 2,000 feet above arrival airport elevation. Approach flight phase will not be active when a VFR approach is in the active flight plan.

Primary Means of Navigation - The airborne navigation equipment that meets the requirements of radio navigation for the intended phase of flight (route to be flown). These requirements include satisfying the necessary level of accuracy, integrity, continuity, and availability for a particular area, route, procedure, or operation. Examples of systems which provide a primary means of navigation include:

a. VOR for domestic en route, terminal, and non precision approach where it is available;

b. VOR/DME for domestic en route above flight level 240, terminal, and non precision approach where it is available;

c. OMEGA for Oceanic Operation;

d. INS for Oceanic Operation;

Protected Zone - In the Free Flight environment, each aircraft will be surrounded by two zones, a protected zone and an alert zone. The protected zone must remain sterile to assure separation. It can be envisioned as a distance-based "hockey puck" with radius equal to half the horizontal separation minimum and vertical extent equal to ± half the vertical separation minimum. The size of the protected zone is a direct reflection of the position determination accuracy.

Protocol – A set of conventions between communicating processes on the formats and contents of messages to be exchanged.

Reliability - The probability of performing a specified function without failure under given conditions for a specified period of time.

Resolution – The smallest increment reported in an ADS-B message field. The representation of the least significant bit (LSB) in an ADS-B message field.

Required Navigation Performance (RNP) - A measure of the navigation system performance within a defined airspace, route, or procedure, including the operating parameters of the navigation's systems used within that airspace. (Source: Adapted from the ICAO Separation Panel).

Seamless - A "chock-to-chock" continuous and common view of the surveillance situation from the perspective of all users.

Sensor – Synonym for interrogator.

Site – Synonym for interrogator.

Side Lobe Suppression (SLS) Transmission – A transmission intended to prevent responses from transponders not in the main beam of the interrogating antenna.

Sole Means of Navigation - An approved navigation system for a given operation or phase of flight that must allow the aircraft to meet, for the operation or phase of flight, all four navigation system performance requirements: accuracy, integrity, availability, and continuity of service.

Special Position Identification (SPI) – A special pulse used in ATCRBS located 4.35 microseconds following the last framing pulse. When used in Mode S, SPI appears as a code in the flight status (FS) field and in the surveillance status subfield (SSS).

Squitter – The transmission of a specified reply format at a minimum rate without the need to be interrogated.

Station-keeping - Station-keeping provides the capability for a pilot to maintain an aircraft's position relative to the designated aircraft. For example, an aircraft taxiing behind another aircraft can be cleared to follow and maintain separation on a lead aircraft. Station-keeping can be used to maintain a given (or variable) separation. An aircraft that is equipped with an ADS-B receiver could be cleared to follow an FMS or GNSS-equipped aircraft on a GNSS/FMS/RNP approach to an airport. An aircraft doing station-keeping would be required to have, as a minimum, some type of CDTI.

Supplemental Means of Navigation - An approved navigation system that can be used in controlled airspace of the NAS in conjunction with a sole means of navigation.

Tactical Parameters - Tactical information may be used to enhance the performance of designated applications. System designs should be flexible enough to support tactical parameters; however, it is not required to provide the parameters in all implementations.

Technical Acknowledgment – Acknowledgment by the recipient that a message was received without error, with no inference of the recipient's intended reaction to that message.

Terminal Area - A general term used to describe airspace in which approach control service or airport traffic control service is provided.

Total System Error (TSE) - Generic: The root-sum-square of the navigation source error, airborne component error, display error and flight technical error. Specific: The root-sum-square of the position fixing error, display error, course selection error and flight technical error.

Track Angle - Instantaneous angle measured from either true or magnetic north to the aircraft's track.

Transaction – The process of accepting and processing an interrogation and generating a corresponding reply.

Trigger – Detection of ADS-B or Ground Uplink synchronization sequence.

Universal Time (UT) – Universal Time is the general designation of time scales based on the rotation of the Earth.

Uplink – Signal propagated toward a transponder.

UTC (Co-ordinated Universal Time) – See co-ordinated time scales.

UTC 1 second epoch signal – The reference timing used to establish message transmit and reception times with precision, as well as the time of applicability of Position and Velocity when the UAT transmitter is "UTC Coupled" to a GPS/GNSS navigation source.

Velocity Uncertainty Category (VUC) - The velocity uncertainty category (VUC) is needed for surveillance applications to determine whether the reported velocity has an acceptable level of velocity uncertainty.

Vertical Profile - A line or curve, or series of connected lines and/or curves in the vertical plane, defining an ascending or descending flight path either emanating from or terminating at a specified waypoint and altitude, or connecting two or more specified waypoints and altitudes. In this sense, a curve may be defined by performance of the airplane relative to the airmass.

Warning - An annunciation that is generated when immediate recognition and corrective or compensatory action is required; the associated color is red. (Source: Advisory Circular AC25 - 11)

World Geodetic Survey (WGS) - A consistent set of parameters describing the size and shape of the earth, the positions of a network of points with respect to the center of mass of the earth, transformations from major geodetic datums, and the potential of the earth (usually in terms of harmonic coefficients).

World Geodetic System 1984 - A set of quantities, developed by the U.S. Department of Defense for determining geometric and physical geodetic relationships on a global scale, based on a geocentric origin and a reference ellipsoid with semi-major axis 6378137 and flattening 1/298.257223563.